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EXAMINER

DO, CHAT C

ART UNIT

PAPER NUMBER

2193

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/698,246

Applicant(s)

FU ET AL.

Examiner

Chat C. Do

Art Unit

2193

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 April 2005.
 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 8-61 and 66-68 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) ☒ Claim(s) 16-34, 45-47, 52-55, 60 and 61 is/are allowed.
 6) ☒ Claim(s) 1, 3, 4, 8-14, 35, 36, 48, 50, 56, 58 and 66-68 is/are rejected.
 7) ☒ Claim(s) 2, 15, 37-44, 49, 51, 57 and 59 is/are objected to.
 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
 Paper No(s)/Mail Date _____
 4) ☐ Interview Summary (PTO-413)
 Paper No(s)/Mail Date: _____
 5) ☐ Notice of Informal Patent Application (PTO-152)
 6) ☐ Other: _____

DETAILED ACTION

1. This communication is responsive to Amendment filed 04/28/2005.
2. Claims 1-4, 8-61, and 66-68 are pending in this application. Claims 1, 9, 16, 26, 35, 45, 46, 48, 50, 52-56, 58, and 60-61 are independent claims. This Office Action is made final.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 3-4, 8-14, 35-36, 48, 50, 56, 58, and 66-68 are rejected under 35 U.S.C. 103(a) as being obvious over Naofumi et al. ("Redundant CORDIC methods with a constant scale factor for Sine and Cosine computation") in view of Fox et al. (U.S. 5,276,633).

Re claim 1, Naofumi et al. disclose an angle rotator for rotating an input complex number to produce a rotated complex number according to an input angle θ (abstract wherein the angle is theta using double rotation method in page 990 under section III), angle rotator comprising: wherein θ_M is a coarse approximation to input angle θ (page 989 right column lines 1-3), a first digital circuit (page 990 left column lines 18-22) that performs a coarse rotation on input complex number based on $\sin \theta_M$ value and $\cos \theta_M$ value, resulting in an intermediate complex number; a fine adjustment circuit (step 3 in

the left column in page 991) that generates a fine adjustment value based on a θ_L value, wherein $\theta_L = \theta - \theta_M$; and a second digital circuit that performs a fine rotation on intermediate complex number based on fine adjustment value, resulting in the rotated complex number (e.g. left column page 991 under theorem 1). Naofumi et al. do not disclose a memory that stores a $\sin \theta_M$ value and a $\cos \theta_M$ value. However, Fox et al. disclose in Figure 3 extensively a sine/cosine generation for using in rotating angle by coarse and fine adjustment (abstract) wherein the $\sin \theta_M$ value and a $\cos \theta_M$ value is stored in memory (e.g. coarse adjustment 311 and 312; fine adjustment 331 and 332). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add a memory for storing the pre-computed values of $\sin \theta_M$ value and a $\cos \theta_M$ as seen Fox et al.'s Figure 3 into Naofumi et al.'s Figure 2 because it would enable to increase the system performance by pre-calculating and storing the values for rotating at a desire angle (col. 2 lines 33-43).

Re claim 3, Naofumi et al. further disclose first digital circuit (page 990 left column lines 2-3 and lines 18-20) is a butterfly circuit having a plurality of multipliers that multiply input complex number by $\sin \theta_M$ value and $\cos \theta_M$ value.

Re claim 4, Naofumi et al. further disclose second digital circuit (page 990 left column lines 2-3 and lines 18-20 and algorithm step 2 in right column) is a butterfly circuit having a plurality of multipliers that multiply intermediate complex number by fine adjustment value.

Re claim 8, Naofumi et al. do not disclose the memory is indexed by θ_M . However, Fox et al. disclose in Figure 3 that the ROM is indexed by θ_M (311 and 312).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add the ROM which indexed by θ_M as seen in Fox et al.'s invention into Naofumi et al.'s invention because it would enable to retrieve the parameters faster and reduce the power consumption.

Re claim 9, it has the similar limitations cited in claim 1. Naofumi et al. do not disclose the memory is indexed by a MSW of input angle and the θ_M is a radian angle that corresponds to MSW of the input angle. However, Fox et al. disclose in Figure 2 the memory is indexed by a MSW of input angle and the θ_M is a radian angle that corresponds to MSW of the input angle (col. 2 lines 61-63). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to have a memory is indexed a MSW of input angle and the θ_M is a radian angle that corresponds to MSW of the input angle as seen in Fox et al.'s invention into Naofumi et al.'s invention because it would enable to retrieve the values of sin and cosine faster.

Re claim 10, it has same limitation cited in claim 3. Thus, claim 10 is also rejected under the same rationale as cited in the rejection of rejected claim 3.

Re claim 11, it has same limitation cited in claim 4. Thus, claim 11 is also rejected under the same rationale as cited in the rejection of rejected claim 4.

Re claim 12, Naofumi et al. further disclose the quantization error reflects a finite memory storage for first value (inherently by finite memory storage for infinite accuracy).

Re claim 13, Naofumi et al. further disclose first value includes a memory quantization error relative to $\sin \theta_M$ value (inherently by finite memory storage for infinite accuracy of the $\sin \theta_M$).

Re claim 14, Naofumi et al. further disclose first value is a binary n-bit approximation of $\sin \theta_M$ value, wherein n is a bit storage capacity for first value in memory (inherently by finite memory storage for infinite accuracy of the $\sin \theta_M$).

Re claim 35, it is a method claim of claim 9. Thus, claim 35 is also rejected under the same rationale in the rejection of rejected claim 9.

Re claim 36, Naofumi et al. do not disclose a step of determining comprises the step of retrieving first value and second value from a memory. However, Fox et al. disclose in Figure 3 extensively a sine/cosine generation for using in rotating angle by coarse and fine adjustment (abstract) wherein the $\sin \theta_M$ value and a $\cos \theta_M$ value is stored in memory (e.g. coarse adjustment 311 and 312; fine adjustment 331 and 332) and step of retrieving the values. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add a memory for storing and retrieving the pre-computed values of $\sin \theta_M$ value and a $\cos \theta_M$ as seen Fox et al.'s Figure 3 into Naofumi et al.'s Figure 2 because it would enable to increase the system performance by pre-calculating and storing the values for rotating at a desire angle (col. 2 lines 33-43).

Re claim 48, it has similar limitations cited in claim 1. Thus, claim 48 is also rejected under the same rationale in the rejection of rejected claim 1.

Re claim 50, Naofumi et al. disclose an angle rotator for a direct digital frequency synthesizer, for rotating a selected point in the complex plane according to an input angle θ , to generate an output representing a single coordinate of a rotated complex number, angle rotator comprising: θ_1 is an approximation of input angle θ (e.g. inherently in digital circuit, value stores in memory cannot be infinite), a first digital circuit that obtains value representing $\sin \theta_1$ from using a value based on θ_M , where θ_M is an approximation of input angle θ (e.g. inherently in digital circuit, value stores in memory cannot be infinite), means (e.g. right column page 989 lines 1-3) for generating a fine adjustment value; a second digital circuit (e.g. page 990 under double rotation method and left column lines 1-5) that performs a rotation of a point in the complex plane whose coordinates are $\sin \theta_1$ and value approximating $\cos \theta_1$, based on fine adjustment value, to produce one coordinate value of an output complex number; and a scaling circuit (e.g. K_1 in the algorithm in right column page 990) that scales coordinate value of output complex number using value approximating $\cos \theta_1$ to generate the single coordinate output. Naofumi et al. do not disclose a memory that stores a $\sin \theta_M$ value and a $\cos \theta_M$ value and addressed by based on θ_M . However, Fox et al. disclose in Figure 3 extensively a sine/cosine generation for using in rotating angle by coarse and fine adjustment (abstract) wherein the $\sin \theta_M$ value and a $\cos \theta_M$ value is stored in memory (e.g. coarse adjustment 311 and 312; fine adjustment 331 and 332) and addressed by θ_M . Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add a memory for storing the pre-computed values of $\sin \theta_M$ value and a $\cos \theta_M$ and addressed by θ_M as seen Fox et

al.'s Figure 3 into Naofumi et al.'s Figure 2 because it would enable to increase the system performance by pre-calculating and storing the values for rotating at a desire angle (col. 2 lines 33-43).

Re claim 56, it has similar limitations cited in claim 1. Thus, claim 56 is also rejected under the same rationale in the rejection of rejected claim 1.

Re claim 58, it is a method claim of claim 50. Thus, claim 58 is also rejected under the same rationale as cited in the rejection of rejected claim 50.

Re claim 66, Naofumi et al. further disclose first digital circuit processes a digital binary representation of intermediate complex number (page 989 right column lines 1-4).

Re claim 67, it has same limitation cited in claim 66. Thus, claim 67 is also rejected under the same rationale as cited in the rejection of rejected claim 66.

Re claim 68, it has same limitation cited in claim 66. Thus, claim 68 is also rejected under the same rationale as cited in the rejection of rejected claim 66.

Allowable Subject Matter

5. Claims 16-34, 45-47, 52-55, and 60-61 are allowed.
6. Claims 2, 15, 37-44, 49, 51, 57, and 59 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

7. Applicant's arguments filed 04/28/2005 have been fully considered but they are not persuasive.

a. The applicant argues in page 2 for claims that the cited references by Takagi and Fox do not relate to angle rotator.

The examiner respectfully submits that both references relate to an angle rotator wherein Takagi reference discloses a method of using CORDIC to rotate (e.g. left column second paragraph under introduction section) and Fox discloses a method of using coarse and fine angle for generating a new point within circle plane.

b. The applicant argues in page 2 for claims that the cited reference by Fox do not disclose or produce both coarse and fine sets of sine/cosine values that could be incorporated into a digital circuit as cited in claimed invention.

The examiner respectfully submits that the circuit in Fox reference is digital circuit and Fox discloses a method of generating a new set of coordinate or point within circuit given a coarse and a fine angle as seen in Figure 7.

c. The applicant argues in page 2 for claims that cited references do not suggest a modification so they would be used to produce the claimed invention.

The examiner respectfully submits that the modification or combination of references is obvious to a person having ordinary skill in the art at the time the invention is made to add a lacking feature in primary reference from secondary

reference because obviously it would enable to increase the system performance by pre-calculating and storing the values for rotating at a desire angle (col. 2 lines 33-43).

- d. The applicant argues in page 3 for claims that Takagi reference does not disclose an input complex number for rotating because the Takagi system always starts its calculation at a fixed point in the X-Y plane.

The examiner respectfully submits that Takagi clearly discloses the CORDIC method requiring an input complex number for rotating in left column second paragraph under the introduction section in page 989.

- e. The applicant argues in page 3 for claims that there is no teaching in either of the references used in the rejection that disclose or suggest using sin and cosine values as inputs to an angle rotation circuit.

The examiner respectfully submits that Fox clearly discloses in column 2 lines 35-43 the tradeoff between utilizing ROM and arithmetic hardware for used in rotating angle.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chat C. Do whose telephone number is (571) 272-3721. The examiner can normally be reached on M => F from 7:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaki Kakali can be reached on (571) 272-3719. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Chat C. Do

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Examiner
Art Unit 2193

June 3, 2005

Kemen *Cha*

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